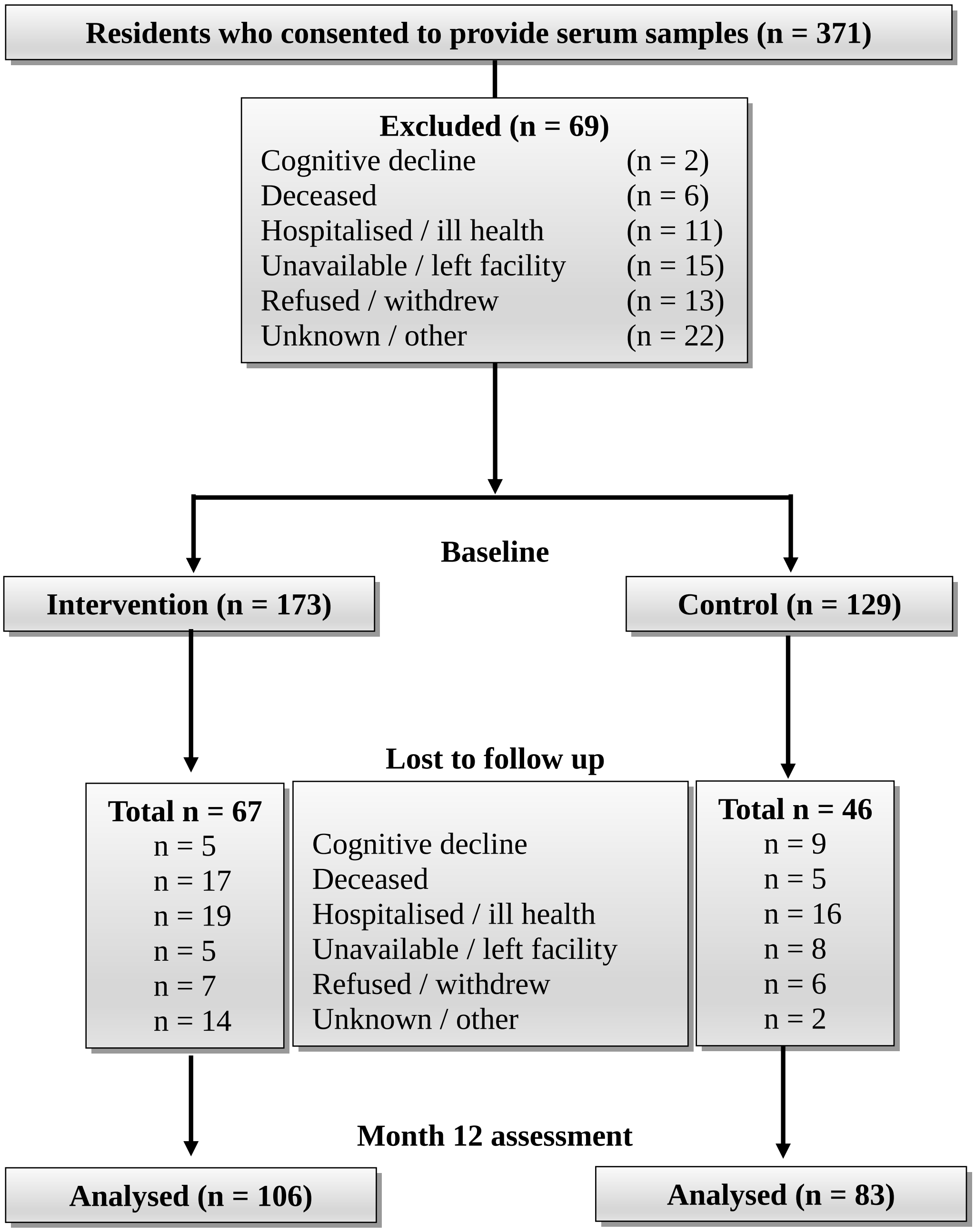
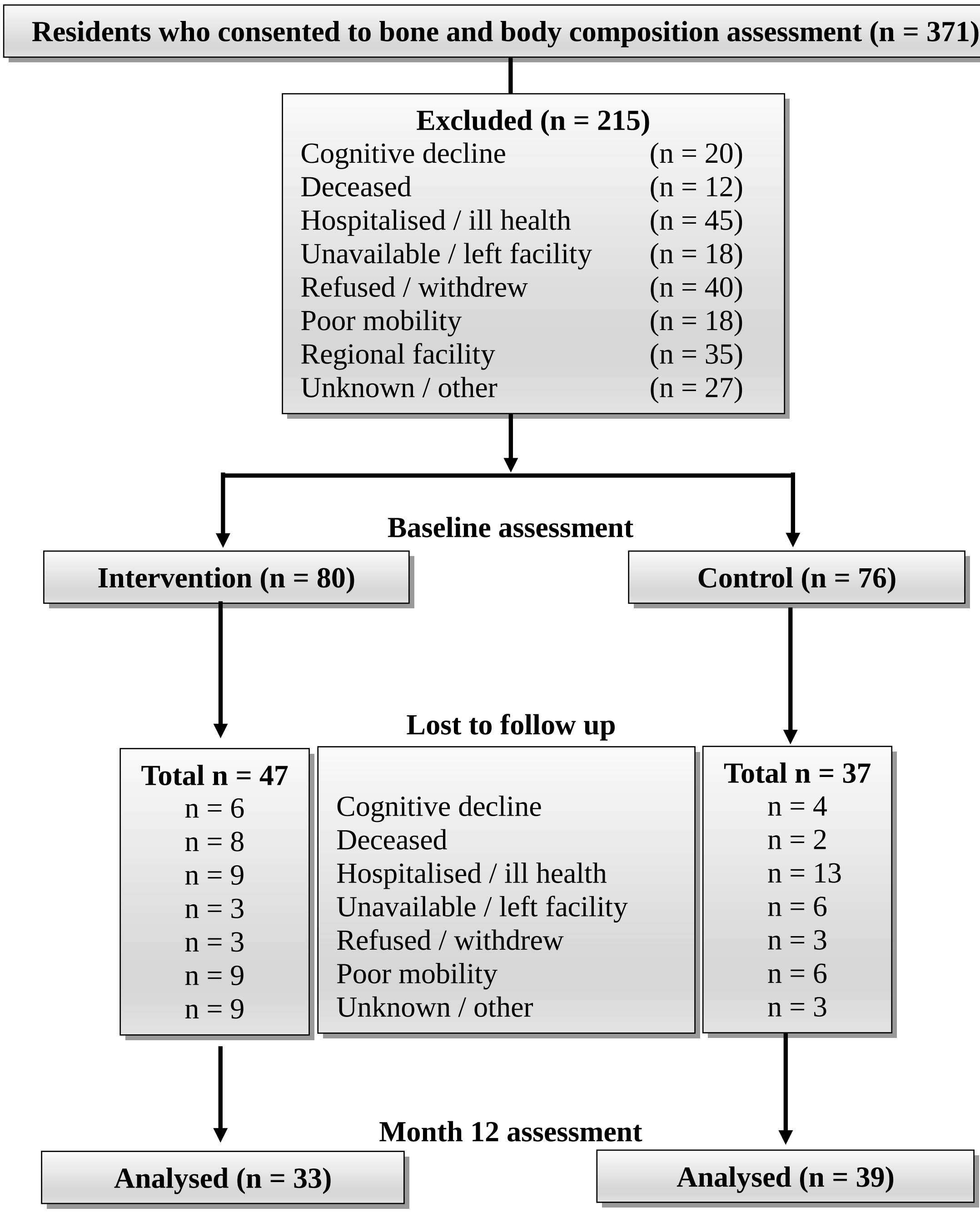
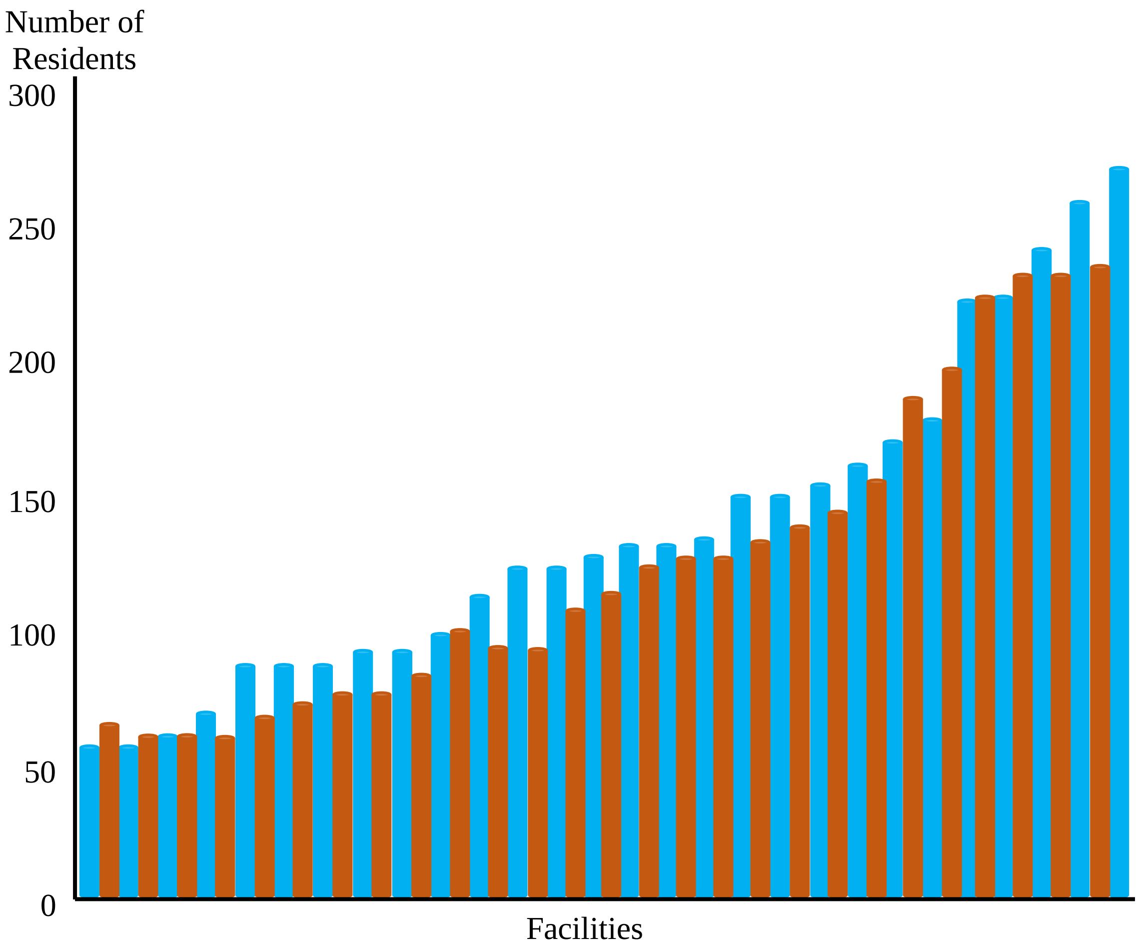
## Supplementary Material



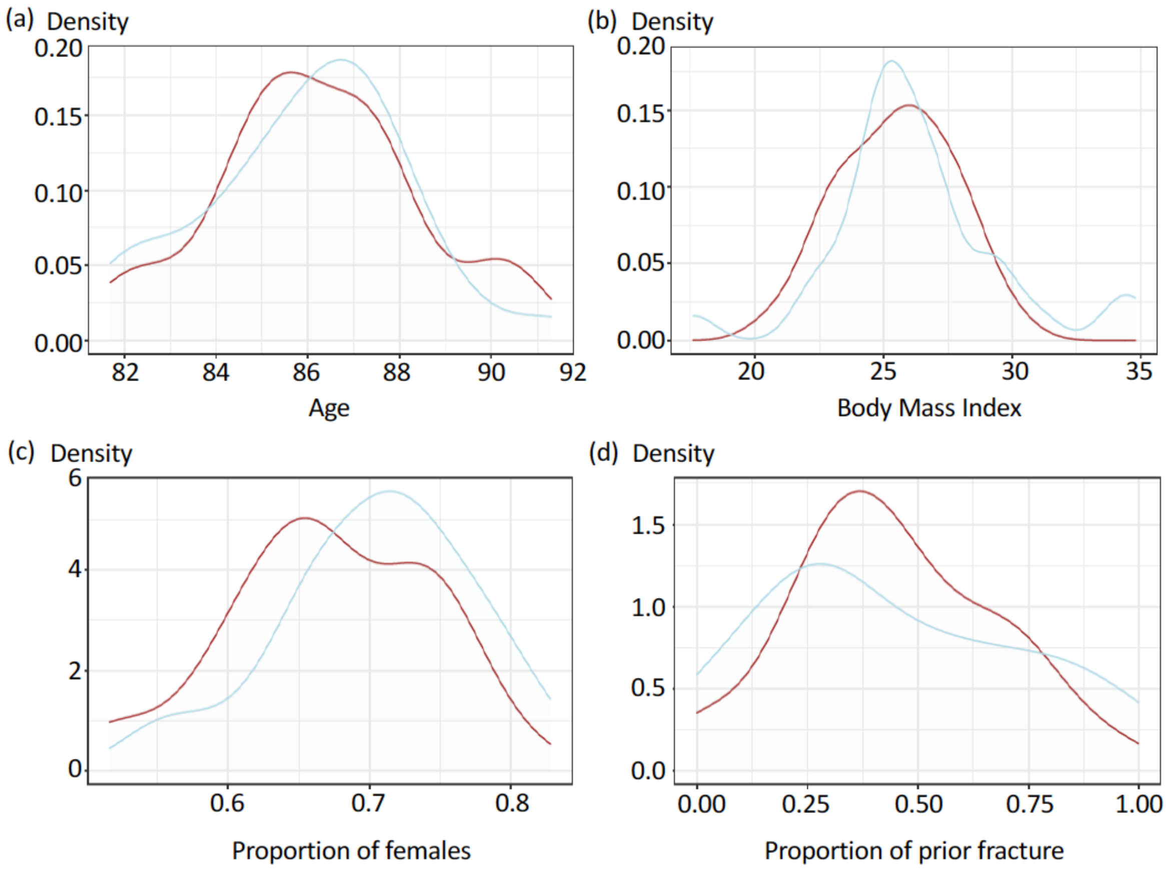

**Supplementary Figure A**: Flow chart for assessment of biochemistry at baseline and month 12 among residents in aged-care facilities randomised to intervention or control.




**Supplementary Figure B**: Flow chart for assessment of bone and body composition at baseline and month 12 among residents in aged-care facilities randomised to intervention or control.




**Supplementary Figure C**: The median number of residents in each facility in the intervention (orange bars) and control (blue bar) groups were 111 (IQR 75 to 147) and 125 (IQR 88 to 163) respectively; not different (P=0·42 by Wilcoxon's rank test). There were 12 intervention and 11 control facilities with between 50-99 residents, 11 intervention and 13 control facilites with between 100 to 199 residents and 4 intervention and 5 control facilities with over 200 residents.




**Supplementary Figure D**: Distribution of the potential confounders. (a) Age, (b) Body Mass Index, (c) proportion of females, and (d) proportion with a fracture history among residents in control (blue) and intervention (orange) facilities. No significant between-group differences were observed.

## Supplementary methods

**Power consideration** Based on a fracture rate of 7% per year in older Australians living in aged-care, (14% over the 2-year study) 2000 participant are needed to detect a 30% reduction in fractures with 80% power.(1, 2) We used an estimation of an average of 60 residents per facility, so that 50 facilities will provide a minimum of 3600 residents. With an estimated 20% yearly attrition rate, 2400 residents will remain by the completion of the 2-year study providing the sample size needed to detect a fracture rate reduction of 30% at 80% power, P<0·05.

**Data Analysis** The study was designed as a cluster randomized clinical trial where participants were clustered within facilities. There are two approaches to the analysis of data: patient-level and cluster-level. We used the traditional cluster-level approach with the mixed effects model to analyze the data. Let the hazard of an outcome for an individual *i* at time *t* be $h_i(t)$. The hazard was modelled as follows: $h_i(t) = h_0(t)exp\left(\alpha_j + \beta_1 Treatment + \beta_2 Age + \beta_3 Sex\right)$, where $\alpha_j$ denotes the random effect associated with the *j*th facility; $\beta_1$, $\beta_2$, and $\beta_3$ represent the effect of intervention, participant's age and sex, respectively. In this formulation, the random effect can be thought of as a random intercept that modifies the linear predictor, while the exponential of the random effect has a multiplicative effect on the baseline hazard function. Scaled Schoenfeld residuals showed that the assumption of proportionality was satisfied. The R package 'coxme' was used to estimate the model parameters.(3) We further used the analyzed the data by taking into account the competing risk of death, and the results remained statistically unchanged. The analysis was conducted on the basis of the intention to treat principle (ITT).

**Markovian analysis** We also conducted a Markvian analysis to gain insights into the transition between states. There were 3 states: (i) no fracture at baseline; (ii) survived and sustained a fracture; and (iii) death. The following table presents the hazard ratio for each pair of states:

**Effect of intervention (intervention vs control)**

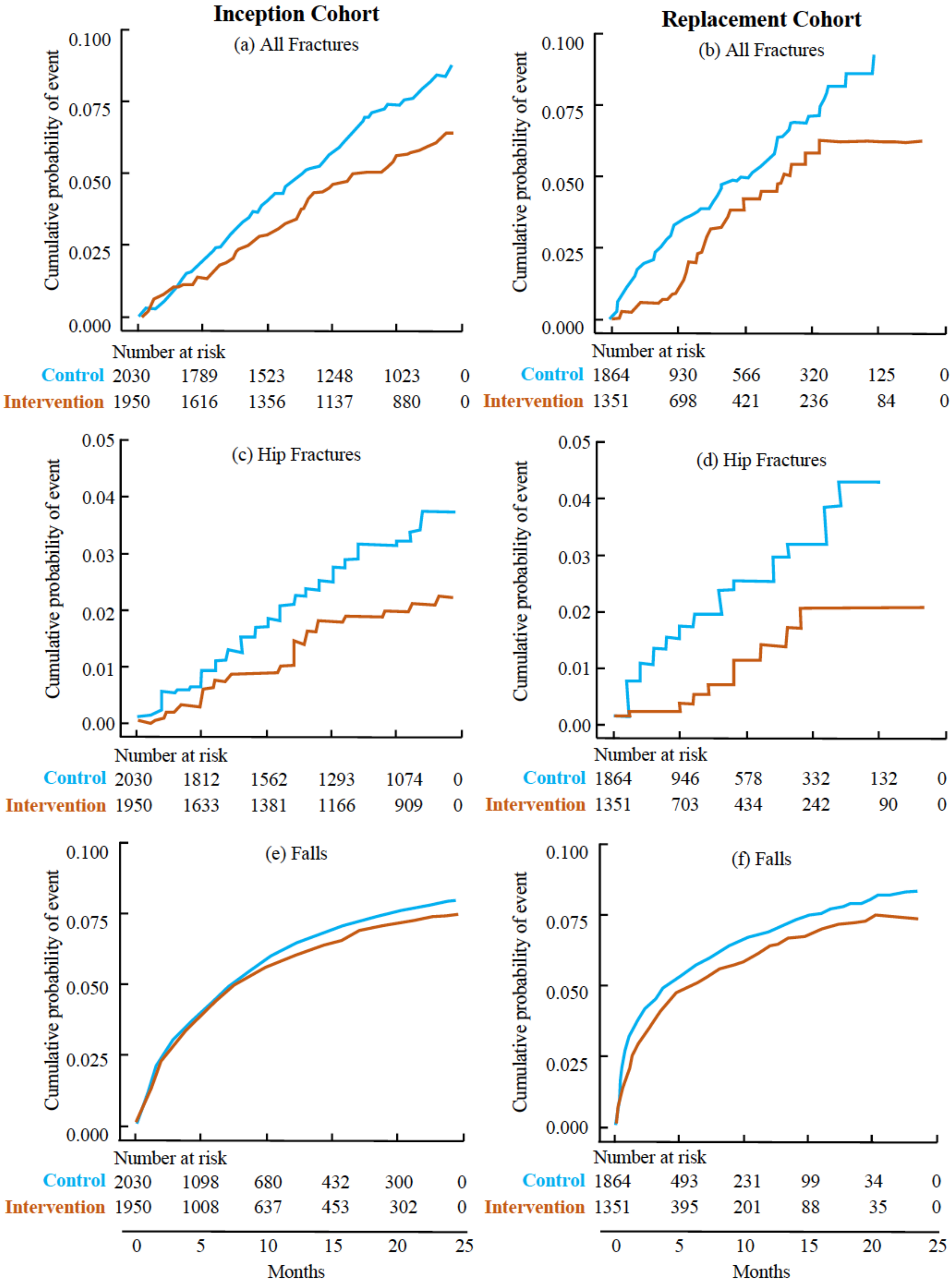
| From | To | Hazard Ratio |
|---|---|---|
| No fracture | Fracture | 0·71 (0·56 - 0·89) |
| No fracture | Death | 1·03 (0·94 - 1·13) |
| Fracture | Death | 1·20 (0·76 - 1·90) |

## References


1. Chapuy MC, Arlot ME, Duboeuf F, Brun J, Crouzet B, Arnaud S, et al. Vitamin D3 and calcium to prevent hip fractures in the elderly women. The New England journal of medicine. 1992;327(23):1637-42.
2. Sanders KM, Nicholson GC, editors. Anti-fracture treatment of nursing home and hostel residetns is cost effective. 10th National Osteoporosis Society Annual Conference; 2004; Harigate, UK.
3. Therneau TM, Grambsch, P. M., Pankratz, V. S. Penalized survival models and frailty. Journal of Computational and Graphical Statistics. 2003;12(1):156-75.

**Supplementary table S1**: Total number and type of first fractures over a 2-year period among residents in the intervention and control groups.

| Fracture type | Intervention | Control |
|---|---|---|
| Ankle / tibia / fibula | 2 | 5 |
| Facial / nasal / skull | 5 | 8 |
| Femur | 5 | 8 |
| Finger / hand | 3 | 3 |
| Foot / toe | 3 | 2 |
| Hip | 42 | 93 |
| Patella | 2 | 0 |
| Humerus | 6 | 17 |
| Pelvis | 10 | 16 |
| Ribs | 10 | 14 |
| Scapula / clavicle | 4 | 6 |
| Spine | 10 | 13 |
| Sternum | 0 | 1 |
| Wrist / radius / ulna | 19 | 17 |




**Supplementary figure E**: The respective cumulative incidence of any fracture was lower in the intervention than control group in both the inception cohort (4·5% vs. 6·4% respectively, P=0·009, panel a) and replacement cohort, (2·5% vs. 3·6% respectively, P=0·044, panel b). Likewise, the cumulative incidence of hip fractures was lower in the intervention than control group in the inception cohort (1·6% vs. 2·8% respectively, P=0·012, panel c) and replacement cohort (0·8% vs. 1·9% respectively, P=0.014, panel d). The incidence of participants having falls was also lower in the intervention than control group in the inception (64·2% vs 70·0%, P<0·001, panel e) and replacement (46·6% vs 53·7%, P<0·001, panel f) cohorts.